



Feasibility Study
for
XCHANGE TELECOM
December 18, 2009

**Fiber to the Home Initiative
Boro Park, Brooklyn NY**

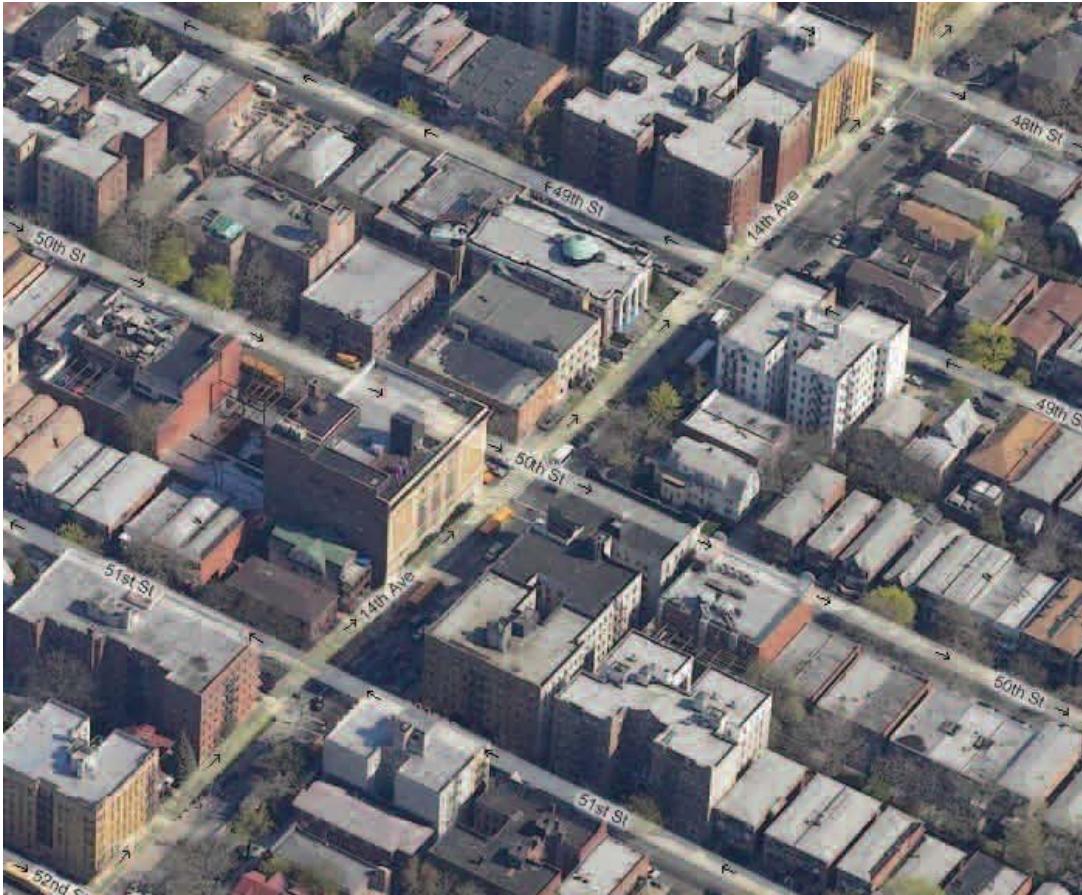


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III. Executive Summary

A. Introduction

On behalf of Matrix Design Group, I wish to thank you for extending us the opportunity to submit this Feasibility Study to XChange Telecom in support of your Fiber-To-The-Home initiative. Attached, please find the conceptual description and understanding that we have of a section of Boro Park Brooklyn and goal to achieve an optical network that will satisfy the needs of the residents of Boro Park.

We have joined together an outstanding team that has extensive experience in network design and construction, as well as a strong reputation within the telecommunications industry. Matrix Design Group with our reputable construction subcontractor team put together a conceptual design and construction concept that we think will not only meet but exceed the goals of XChange Telecom. This proposed team organization is designed with the intent to provide you with the most qualified individuals for the successful completion of the Network Project. You will be pleased to see that we are a multi-disciplinary group of engineering, design, management and construction professionals capable of managing and meeting all of your project goals and objectives.

We sincerely hope that Xchange Telecom will look favorably on this Study. Please contact us if there are any questions or comments

B. Project Understanding

In this proposal Matrix has sought to carefully address the needs and goals of Xchange Telecom as well as all factors that will impact the scope, cost and delivery of this network initiative. After careful analysis of the request for proposal we have come to understand that the project goals and requirements include:

- The Xchange Telecom is seeking to deploy a fiber optic network and fiber-to-the-home (FTTH) network to serve approximately 50,000 potential residential, commercial, institutional and governmental customers within a section of Boro Park Brooklyn NY.
- An estimated 50,000 residential homes are to be passed in the city. Approximately 80% are 3-4 family dwellings and 10% are multi-dwelling apartment buildings and 10% single family dwellings.
- An estimated 1,320 commercial customers are to be passed in the city.
- Approximately 47,000' of underground plant will be constructed.
- Approximately 158,400' of aerial plant will be constructed within the easements. All the aerial plant will be built with guy strand suitable for installation of new fiber optic cable.



- Approximately 6,200 building drops will be installed from easement fiber plant to each building.
- Each building whether it be a single family or multi-family dwelling shall be provided a NID Network Access Device, which will then distribute to in the case of the multi-family dwellings each subscriber independently.
- The main backbone cable will consist of a 432ct fiber optic cable with laterals spliced in feeding each block with a 24ct fiber optic cable.
- Each backyard easement will be provided with 2 fiber splitters located aerially on the utility poles.
- Each subscriber will be provided a new Cat 5 cable drop to their residence from the building mount NID.
- Although there is technology available that allows the delivery of broadband service over existing customer premise wiring, for reliability and customer service and satisfaction considerations we will be recommending re-wiring the customer premise.
- For this design a head end facility has been located at the office of Xchange Telecom and will include all termination equipment electronics and cable management.

C. Company Information



Matrix Design Group, Inc. (MDG), www.matrixdg.com, was formed in response to the rising demand for engineering and design services to support the expansive growth of the telecommunications industry. With that vision, MDG has evolved into a full service provider of telecommunications solutions that services both the communications and competitive access industries. MDG has established a reputation as an innovative leader in the planning, design, and project/construction management of various infrastructure related projects.

MDG offers a full range of engineering and design services, allowing us to provide turnkey solutions to infrastructure based companies. Providing turnkey solutions is an area where our team truly excels. Working with experienced builders of communications systems, our staff provides significant experience in each of the key disciplines needed to build your network. From preliminary budgeting, to design, approval, and final system acceptance, MDG is uniquely qualified to handle all of your needs. We have an understanding of all areas of your network, providing the continuity of service that is difficult to find anywhere else. We believe it is this level of service that makes our company surpass all others.

MDG's expertise in project and construction management allows us to define and represent our client's needs through the entire project. Our services range from bid negotiations; contractor coordination; construction review; project scheduling; material management; permitting, contract administration; close out and warranty inspections. Our as-built documentation for the telecommunications industry has allowed carriers to manage their assets efficiently, and provides the basis for value engineering, long term planning, and asset valuations.

One of the keys to timely completion of this project is the ability to file and obtain approvals from the various permitting agencies that have jurisdiction over the scheduled work. MDG has permitting experience in municipal and county permitting; state and federal agency permitting, including departments of transportation.

IV. Design, Engineering and Project Management Requirements

A. Design and Mapping Approach

The design and mapping approach will be multi-faceted with a strong emphasis on providing the contractor/installer with top rate field documentation (i.e. field drawings, job sheets) to create a seamless installation process. Included in the field documentation will be pole numbers, span lengths, splice assignment sheets, cable route forms, manhole information and a detailed material list. Another objective in the design phase will be to identify any possible permit issues. Identifying these permit issues ahead of time will help in the mobilization and allocation of the construction crews to regions that have less constraints on installation activities until the permits have been secured for the more difficult regions.

B. As-Built Drawings

Upon completion of the project, Matrix will provide final as-built drawings incorporating data collected by the QA/QC inspectors during the construction phase. The data obtained by the inspectors will include but is not limited to - running line offsets, pole numbers, splice and slack coil locations, span lengths, conduit depths, type and manufacturer of material as well as other utilities encountered during installation. These redlines will be incorporated into the overall final mapping plans and will represent all field conditions.

As-built documentation will include:

- Final cable route location
- Duct assignments
- Manhole locations
- Splice and slack locations
- Hard copy of final as-built drawings
- CD-ROM of final as-built drawings

C. Field Survey

1. Existing Utility Locates/Research

Matrix will deploy survey crews to review the proposed route to help determine the presence and location of existing underground utilities. These survey crews will:

- Conduct an inspection of the area and make visual observations of utilities that may be present by visually identifying valve covers, hydrants, catch basins, manhole covers, etc.
- Contact the local one-call center to determine the name and contact information of the utility owners along the proposed route.

2. New Underground Conduit Design

Matrix will deploy survey crews to conduct a detailed survey along the proposed construction routes. These survey crews will:

- Transfer data obtained during the field locate to red-line drawings
- Determine constructible locations for the placement of the conduit infrastructure
- Determine locations for access points and manholes
- Establish plow, trench and bore locations

3. Existing Verizon Conduit Design

Matrix will deploy survey crews to conduct a field verification of the existing conduit system. These survey crews will:

- Contact local Verizon Representative to determine if existing conduit system can be used for mainline cable runs.
- Verify location and quantity data from the existing conduit system as-built drawing.
- Obtain manhole location measurements at each existing manhole/handhole location (i.e. distance from edge of pavement, nearest intersection)
- Transfer survey data obtained in the above steps to the baseplan drawings.

4. Aerial Design

Matrix will deploy survey crews to perform pole line surveys. The design will be based on the National Electric Safety Code (NESC) and the pole owner's requirements. The pole line survey will include:

- Pole ownership, height, class and number
- Pole guying requirements
- Span length measurements
- Identify make-ready locations (make-ready to be performed by Verizon)
- Identify location of the existing cables and guy strand.

D. Design Topology

1. Network Overview

This network will be designed as an independent system consisting on customer owned conduit system and customer owned fiber optic cable network with a customer owned node facility. The node located at 3611 14th Street will support 5 distribution backbone cables and all applicable network gear. The distribution backbone cables will run southerly along the 5-Avenues to approximately 60th Street. These backbone cables will support the tie-ins of all the easement lateral cables running to each backyard easement.

2. Node Facilities

This node facility will be fully equipped with environmental systems capable of maintaining the interior environment at 72 degrees F. In addition to the primary power system, all equipment facilities will have complete battery backup for the electronics (-48V DC) as well as an emergency generator backup power system.

3. Main Backbone

The main fiber optic backbone will consist of a 432ct FOC and will be the main trunk feed to all the backyard easement lateral feeds. The Backbone will be installed within a customer owned conduit system consisting of 2-4" pvc conduit with 3-1.25" innerduct. Manholes will be placed approx. every other street intersection.

A typical easement plan can be found in the attachment section in the back of the study

4. Easement Laterals

The lateral cable will consist of a 24ct FOC and will be the feeder cable to the backyard easements. The lateral feeds will be installed within 1-1.5" HDPE conduit that will tie into the backbone manhole system through a new handhole placed in the sidewalk area at the location of the entry. From the handhole we anticipate two options of connecting to the rear easements. First, trench down either a driveway or walkway to the existing pole line. Second, trench to the nearest building commercial or residential apartment build corner and sweep up the building to an approx. height of 10' in protected conduit. Then travel along the building with the fiber using cable clamps spaced every 10' to a point closest to the pole line in the easement. The cable will now be laced aerially to a strand wire connecting the poles (approx 9) in the easement. The lateral cable within the easement will have 2-splitters that all the customer fiber drops will be spliced into.

5. Customer Fiber Drop

The customer fiber drop will consist of a 2ct FOC that will be an aerial connection from the customer home to the nearest utility pole then travel back to one of the two lateral cable splitters. The customer drop will follow the same path that the existing telephone and cable company's have taken. It is our recommendation that during the initial phase of construction of the backyard easement facilities, customer service drops are extended to each dwelling from the network access point (NAP), to a blank Network interface device (NID) located at each premise. Construction of customer service drop facilities during network construction helps to better utilize the construction budgets and minimizes trip charges in the future. Further, it has been proven that this type of "pre-installation" activity creates customer interest and helps to increase the buy rates for the pre-installed serving area.

A typical easement plan can be found in the attachment section in the back of the study

E. Make Ready Work (Verizon and CATV)

Because the backyard easement feed the residents with telephone and cable aerially via utility poles, potential make ready moves would be required by the utility companies. The reason for these make ready moves is to create a separation between the cable and telephone companies facilities that would allow for the installation of Xchange Communications fiber plant.

F. Project Management and Construction Coordination

Matrix's ability to provide a complete overall management for this project allows us to optimize the necessary control to ensure the timely completion, quality of work, and cost effectiveness of each undertaking. We approach each endeavor from the client's point of view and develop a strategy that will meet or exceed their objectives.

Our skilled professionals will be there from design, final network acceptance, overseeing every phase of the project. Matrix will prepare weekly reports outlining the progress made during the week and to identify and remove any obstacles that may create delay's in the project.

Matrix recognizes that the engineering, design and implementation of communications networks is a fast-track industry, therefore, stringent, project-tested management practices will be implemented to ensure all facets and components of the planning, design, and construction process have received the appropriate level of attention necessary for a successful project. Our strength comes through the integrated services we offer our clients and our commitment to their ongoing success. We create an atmosphere built around teamwork; both within our company and in the co-operative partnerships we form with our clients.

G. Subcontractors

Matrix will employ qualified subcontractors and employees for certain tasks within the project scope. Our efforts in hiring subcontractors will be based on the following: experience, number of employees, quality equipment used, references and there base location. Contractors will be hired in accordance with the appropriate union qualifications.

H. Fiber Management

The creation of an overall map to show the aerial and underground cable, splices, poles and manholes will be the corner stone of this task. The locations of the splices will be dependent on the number of lateral feeds we can provide without exhausting our conduit capacity along the main backbone route. Other activities that will help in the management process are the following:

- Splice Assignment Sheets will be created to identify individual fiber usage.
- Route Forms will be created to identify footages of the fiber along the pole lines and manholes as well as to the splice locations. These sheets prove to be extremely important for emergency maintenance activities due to unpredictable breaks in the line. Should the fiber have a break a technician can send a light through the

line in the Node to get a footage reading and cross reference the forms to pinpoint the location, thus reducing the response time.

I. Restoration

Based on our extensive underground utility construction experience and working knowledge of a wide variety of state/county/local regulatory agencies and right-of-way owners throughout the tri-state area, Matrix recognizes the importance of maintaining and restoring all properties accessed or disturbed during construction. Upon completion of excavation work all surfaces will be restored to a condition equal or better than original condition. All restoration work will be performed in accordance with the specifications, standards and procedures set forth by the governing agency or applicable right-of-way / property owner. Matrix strives to maintain a clean and hazard free work area including daily removal of spoils, unused material and debris from the property.

J. Fiber Splicing and Testing

1. Fusion Splicing Procedures

Fiber optic splicing will be performed by the fusion splicing method. Laboratory testing and field experiences have shown that fusion splicing provides the ultimate splice-loss results with the greatest splice longevity. In addition to the performance benefits, fusion splicing allows for mass-fusion splicing of up to 12-fiber ribbons, which greatly increases splicing production and reduces splicing costs for the project.

The following is a general description of the typical procedures associated with fusion splicing:

i. Cable Preparation

Fiber optic cables tails are brought inside a mobile splice lab or controlled environment, and the technician enters them into the splice closure according to the manufacturer's specifications. The appropriate amount of slack is stored in the lower half of the closure for future use if necessary. The fiber is measured to length and routed into to the splice trays. The fiber is then cleaned and prepared for splicing.

ii. Fiber Preparation and Fusion Splicing

Once the fibers are cleaned and prepared, each fiber or ribbon is cleaved and spliced to the corresponding fiber from the other tail. Care is taken to orient the fibers in a one-to-one fashion. Each fusion splice is then placed inside a splice protection sleeve and heated to adhere the sleeve to the fiber. The protected splice is then placed into the splice holder chip in ascending order. All cables and splice trays are clearly labeled to facilitate identifying fibers by number, color assignments and direction.

iii. Cable / Splice Housing Final Storage

After completing all necessary splices, the technician closes the splice housing, and pressurizes the closure to 5 psi to flash test the seal. When the test is completed, the housing is de-pressurized. The cable is neatly coiled and the

splice closure is racked on the side of the hand hole or manhole and secured as required. In the case of an aerial splice location, the closure is hung on the strand, and the tails are lashed out securely.

2. Testing Procedures

This section describes the processes that will be used to complete network acceptance test on all fiber optic spans. The fiber optic path will be analyzed in several steps in order to complete a network acceptance test. All termination splices will be checked with a visible light source in order to verify the correctness of their position in the termination panel as well as color-to-color match. Next, all termination splices will be measured with a GN Netttest CMA 4000 Optical Time Domain Reflectometer (OTDR) to determine if they all meet the spec set forth by in the specifications for the given type of fiber.

Typically, non-zero dispersion shifted fiber is tested in the 1550 nm wavelength only. Single mode fiber is tested in both the 1550 and 1310 nm wavelengths. Multimode fiber is tested in both the 1300 and 850 nm wavelength. All termination splices will be measured with a launch reel of at least 1 km in length attached to the OTDR. The traces will be numbered sequentially according to the port position, named according to the test location, and stored electronically.

After verifying that all termination splices are within spec, the overall span will be tested in a similar manner. A GN Netttest CMA 4000 OTDR will be used to measure the optical length of the span as well as the loss associated with each field splice along the path. All associated fibers will be tested bi-directionally. The traces will be numbered sequentially according to the port position, named according to the test location/ end location, and stored electronically. Utilizing GNNetttest emulation software, a test report will be generated listing the bi-directional splice loss associated with each fiber at each splice location along the span.

The final step in completing a network acceptance test is the end-to end power test, which verifies continuity between the end points on each fiber as well as measures power loss across the path. Exfo FOT-920 Maxtesters will be used to complete bi-directional dual wavelength power testing. Utilizing EXFO Toolbox emulation software, test results will be compiled in tabular form. All reports and electronic data will be submitted to the customer as part of the final as-built documentation package, and also stored on file for future reference.

K. Permitting and Right-of-Way Requirements

From the onset of the network design solution, the Matrix team recognizes and understands the complex maze of paperwork and regulatory processes associated with permit acquisition and jurisdictional regulations. Matrix, with its experienced construction associates, is ideally suited to provide a seamless approach to permit acquisition. Matrix is particularly adept at working and coordinating with various transportation and state/county/local regulatory bodies.

L. Traffic Control Plans

Keeping the traveling public moving safely and conveniently is a major responsibility. This is especially important in construction work zones, which, if not properly managed, can be hazardous to construction personnel and motorists. Typical accident rates are three to five times higher in work zones.

To reduce the likelihood of occurrence and to reduce the impact of incidents on motorists and construction zone personnel, we propose that a typical traffic control plan be developed and coordinated with the local uniformed police department. The Traffic Control Plans will be designed in accordance with the applicable NYDOT and MUTCD standards.

The fiber routes will travel in and out of traffic lanes and pass from the vicinity of moving vehicular and pedestrian traffic to rural less traveled paths. Special attention must be paid to areas of changing conditions as well areas of intense use and assure protection of traffic is a priority in all areas.

V. Service Installation Requirements

A. House Drop Service Work

The customer fiber drop will be run from each premise location to the nearest splitter location. The drop cable will be run consistently with the current accepted house drop applications.

B. In-House Wiring and Activation Work

With any successful network deployment, the most important and most overlooked aspect of the build is the customer interface. Several issues come into play in this area and can be summed up into three distinct areas.

As it has been determined that FTTH will be used, there are still many questions to be answered regarding how service will be delivered inside of the home. As almost all of the properties on this build are MDU's, there may not be any single answer for how best to wire these homes.

The most desirable method for wiring service would be to install all premises with Cat5E or CAT6 wiring. This could provide for up to 1Gbps of Ethernet connectivity between telco equipment and customer premise equipment. In keeping all traffic natively Ethernet between the telco equip and the CPE there will be no additional complex modem equipment to purchase, install and support. It is our opinion that all new CAT5e / CAT6 wiring should be installed in each building unless it is physically impossible to do so. While the initial labor costs to do so could be high upfront, in the long term new inside wire will be the most cost effective and best performing solution.

In the cases where there are buildings that cannot be rewired, there are two solutions that could be employed to reuse existing wiring.

1. HPNAv3 (Home Phone Networking Alliance) – This technology delivers broadband over existing inside telephone wiring or existing coaxial cable. It requires the installation of “HPNA modems” for each location. For Boro Park, it is assumed that coaxial cable may not be available in many units. While HPNA v3.0 is capable of delivered speeds of up to 128Mbps, this will only occur if the condition of the existing telephone wiring is optimal. This product is often marketed as “simply plug it in and it works”. The truth is that in large, older buildings where the condition of the inside phone wire is unknown, there could be a significant amount of labor and retrofit work to get HPNA to work optimally. As mentioned above, if there is no possibility of running new cabling inside these buildings, HPNA is an acceptable alternative – but will almost certainly require some significant effort in retrofitting the existing wires.
2. VDSL – While most people think of DSL as a broadband technology that is used “outside” of a premise, it is also very useful in delivering broadband “inside” of large MDU buildings where rewiring is impossible. The concept behind VDSL for “inside wiring” is to bring a large broadband pipe into the phone/wiring closet of a large MDU – then install a VDSL DSLAM and use existing inside phone wire to deliver broadband to a VDSL modem in each unit. As with HPNA technology mentioned above, VDSL will work very well when the condition of the inside wiring is optimal. It is highly likely that in order to have VDSL work properly, a significant amount of labor will be required to retrofit existing phone wiring.

VI. Staffing Considerations

For the financial analysis of the proposed project, a mean average of one employee for 1000 subscribers was used. At various times during the project, that number may increase or decrease. A summary of the recommended technical staffing levels follows below. The numbers and types of employees may need to be adjusted to suit varying needs of the project.

- Outside Plant Technicians: During the construction phase of the project and early on after service starts to be offered, the number of outside plant staff required will be higher than in later years. Once the network has matured a group of 3 outside plant employees can handle the volume of day to day activity (patching, splicing, drop wire work). During the early years, when there potentially could be a lot of contract labor doing installation and construction work, these 3 OSP techs will primarily function as quality control. In addition, these techs should be cross trained to function as repairs techs for inside and outside troubles.
- Repair Techs: As mentioned above, due to the initial high volume of installations, contracted labor would probably be used for customer installation work. However, it is essential that any repair techs are actual employees. In my experience, having contract labor perform repair work (especially on a new install) is counterproductive. Having an in house repair tech(s) will assist with flushing out faulty contractor installation work. In addition, in house repair will usually fix the trouble on the 1st truck roll. If a good quality control system is put in place during installations, the number of service

tech staff needed will be far less. 1 fulltime repair tech per 4000 customers is sufficient. When the trouble volume occasionally spikes, outside plant techs should be cross trained to do repair work.

- Installers: After the initial flood of installation work in the early years drops off, it will no longer be necessary to maintain a contracted installation force. I would recommend in house installers be used. In the absolute worst case scenario, an installer should be able to do 2 installs per day (assuming high labor wiring). In any case, a minimum of 2 installers should be employed. Additionally, repair staff and outside plant staff may be used during peak times to augment the installations team.
- Inside Plant: This would include all systems technicians. For a 2 play service offering of phone and internet, a crew of 3 engineers/techs should easily be able to effectively maintain the network equipment. This number is needed on day 1 and should remain the same regardless of the number of customers. It is essential that all systems staff are competent to manage all of the equipment. You do not want a scenario where 1 employee is the Class 5 switch person, and another one is the router person, and a third person is the access equipment (GPON) tech . Having 3 fully cross trained employees will provide ample coverage for daily operations and after hour on call coverage.
- Customer Technical Support (Help Desk) – Having the right number of staff for technical support can be tricky as there are often peaks and lows. You can never have enough staff when there is a peak (like during a network outage), but the goal is to provide enough coverage that during normal operating conditions, customers can get support without waiting more than a few minutes. You may also find that early on in the network build as a flood of new customers are installed the help desk load could be very high. The reason for this almost always customer education. New customers tend to call in more frequently. It is my recommendation that technical support be available 8am – 10pm x 7 days a week. To effectively achieve this coverage, you would need a minimum of 4 full-time help desk staff regardless of call volume. It is difficult to determine if more than 4 would be needed because of the number of variables. What I can say is that if the installation work is of a high quality and there are few repair calls, 4 employees could handle a customer base of 10000.
- Customer Service (new service, change service, collections): As with the help desk, customer service will need a baseline level of staff regardless of the number of customers. The customer service group does not typically cover as many hours as technical support. Typically they would work from 8am – 8pm x 6 days a week. To achieve this, a staff of 3 CS reps would be needed. Also, as with help desk, it is difficult to determine the exact number of staff needed. Under no circumstances should more than 6 be needed to support a network of 10000 users. If it is possible, CS and HD employees should be cross trained to serve in both capacities. This could assist in keeping the number of employees needed to maintain operations low.

VII. Upstream Broadband Link Considerations

In order to provide broadband internet services over FTTH the telco must purchase a large amount of access from 1 or more IP transit providers. How much bandwidth to purchase is dependent upon a few factors:

1. How much access will you be selling to your customers? 1Mbps , 10Mbps, 50Mbps? A mix of offerings? For the sake of this engineering estimate, we will assume all customers will be provisioned for 10Mbps of access.
2. What will the oversubscription ratio be? For broadband services, a ratio of 20:1 is considered excellent. Oversubscription ratios of 40:1 or higher will most likely have your customers complaining of slow speeds. For this discussion, we will assume a 25:1 oversubscription ratio.

If the telco has 10,000 subscribers each receiving 10Mbps access, the telco would need to purchase 4Gbps worth of access to maintain a 25:1 ratio. Assuming the telco can gain access to a carrier neutral telecom “hotel”, the telco could most likely buy IP transit access at \$10 per Mb or less. That translates to \$40,000 per month for 4Gbps. If the telco cannot get access to a carrier hotel or construct to one, the cost per MB will increase as they will have to buy local loops to deliver the transit.

As mentioned above, the telco may buy transit from 1 or more transit provider. Buying access from more than 1 provider will give the benefit of service redundancy and increased route performance. While it is not absolutely necessary have more than 1 transit provider it is highly recommended.

It is also highly recommended that the telco secure an IP address allocation from ARIN. This will allow the telco to easily switch transit providers without having to readdress all of their equipment. To receive an IP allocation, a standard justification for will need to be filled out. If the telco has 10,000 subscribers, it will need at least 10,000 IP addresses. ARIN’s current fees for this size allocation are ~\$4500 per year.

Lastly, the telco must have a router to handle the IP traffic. There are many manufacturers who make routers to handle this quantity of traffic. Costs can range and vary greatly from \$10k to \$100k and beyond.

VIII. Business Plan Financial Analysis

XChange Telecom Business Plan Financial Analysis

XChange Telecom

Business Plan Financial Summary Detail

XChange Telecom

Business Plan Financial Summary Detail

REVENUE ASSUMPTIONS:											
URBAN											
Residential HH passed: yr end	41,000	12,300	26,650	38,950	41,000	41,000	41,000	41,000	41,000	41,000	41,000
Businesses passed: yr end	41,000	500	2,500	4,100	4,100	4,100	4,100	4,100	4,100	4,100	4,100
Take rate, end of year: RES	24%	27%	28%	30%	31%	32%	33%	33%	34%	34%	35%
number of subs end of year: res	7,196	10,906	11,890	12,300	12,710	13,120	13,530	13,940	14,350	14,350	14,350
number of subs: average for yr: res	2,952	4,244	3,711	984	410	410	410	410	410	410	410
Take rate, end of year: BUS	1,476	2,122	9,051	11,388	12,095	12,505	12,915	13,325	13,735	13,735	14,145
number of subs, end of year: bus	30.0%	32.0%	32.5%	33.0%	33.5%	34.0%	34.5%	35.5%	36.5%	37.5%	
number of new subs during year: bus	150	800	1,333	1,353	1,374	1,394	1,415	1,456	1,497	1,538	
number of subs, average for yr: bus	150	650	533	21	21	21	21	41	41	41	
	75	325	1,066	1,343	1,363	1,384	1,404	1,435	1,476	1,517	
Ave rev/mo/res/sub (all services)	\$83.97	\$85.65	\$87.36	\$89.11	\$90.89	\$92.71	\$94.56	\$96.46	\$98.38	\$100.35	
Ave rev/mo/bus/sub (all services)	\$366.80	\$374.14	\$381.62	\$389.25	\$397.04	\$404.98	\$413.08	\$421.34	\$429.77	\$438.36	
REVENUE ESTIMATES											
residential	\$1,487,280	\$2,180,725	\$9,488,364	\$12,188,089	\$13,192,071	\$13,912,045	\$14,655,542	\$15,423,213	\$16,215,729	\$17,033,776	
business	\$330,121	\$1,459,136	\$4,882,831	\$6,272,028	\$6,495,139	\$6,724,667	\$6,960,777	\$7,255,467	\$7,612,022	\$7,979,936	
install'n charge revenue	0.25	\$243,900	\$415,763	\$358,163	\$76,875	\$33,825	\$33,825	\$36,900	\$36,900	\$36,900	
TOTAL REVENUES	\$2,061,301	\$4,055,623	\$14,729,357	\$18,536,991	\$19,721,036	\$20,670,537	\$21,650,144	\$22,715,580	\$23,864,650	\$25,050,612	
Unit Cost of Goods Sold	Residential	14.25	14.30	14.35	14.40	14.45	14.50	14.55	14.61	14.66	14.71
	Commercial	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25
OPERATING EXPENSE											
Cost of Goods Sold: res.	252396	364032	1558566	1869677	2097491	2176247	2255544	2335387	2415778	2496724	
bus:	19125	82875	271894	342401	347629	352856	358084	365925	376380	386835	
Pole attachment fees,	0	4950	9800	9800	9800	9800	9900	9900	9900	9900	
Outside Plant emergency repair contract	3000	12000	12000	12000	12000	12000	12000	12000	12000	12000	
Professional Services	25000	50000	50000	50000	50000	50000	50000	50000	50000	50000	
Parts & materials	0	103370	150828	163460	16713	172972	177492	180919	184333	184333	
Power/heat/fuel etc.	1200	4800	4944	5092	5245	5402	5565	5731	5903	6021	
Vehicles	14000	21420	29131	37142	37885	38643	39416	40204	41008	41828	
Wages & Salaries	830000	844350	1770668	271522	3810474	4235206	4710295	5231521	5816233	6472485	
Rent	75000	75000	75000	76500	78030	78591	81182	82866	844333	850000	
Property Insurance	1100	2200	2310	2426	2547	2674	2808	2948	3096	3250	
Liability Insurance	600	1200	1212	1224	1236	1249	1261	1274	1287	1299	
FAPs ground rent @ \$5K per unit	0	20000	25000	30000	30000	30000	30000	30000	30000	30000	
insurance, on Hub and other relevant property	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	
Directors & Officers insurance	150000	150000	150000	150000	150000	150000	150000	150000	150000	150000	
Miscellaneous	25000	35000	45000	50000	50000	50000	50000	50000	50000	50000	
Marketing	5000	15000	20000	25000	30000	35000	40000	45000	50000	55000	
Operating Expenses Contingency	174171	217351	501774	676752	822704	888047	9566505	1031037	111342	1204467	
TOTAL Operating Expenses	22360349	1625592	2028608	6316349	7706572	8288437	8927380	9623009	10392128	11241969	

XChange Telecom

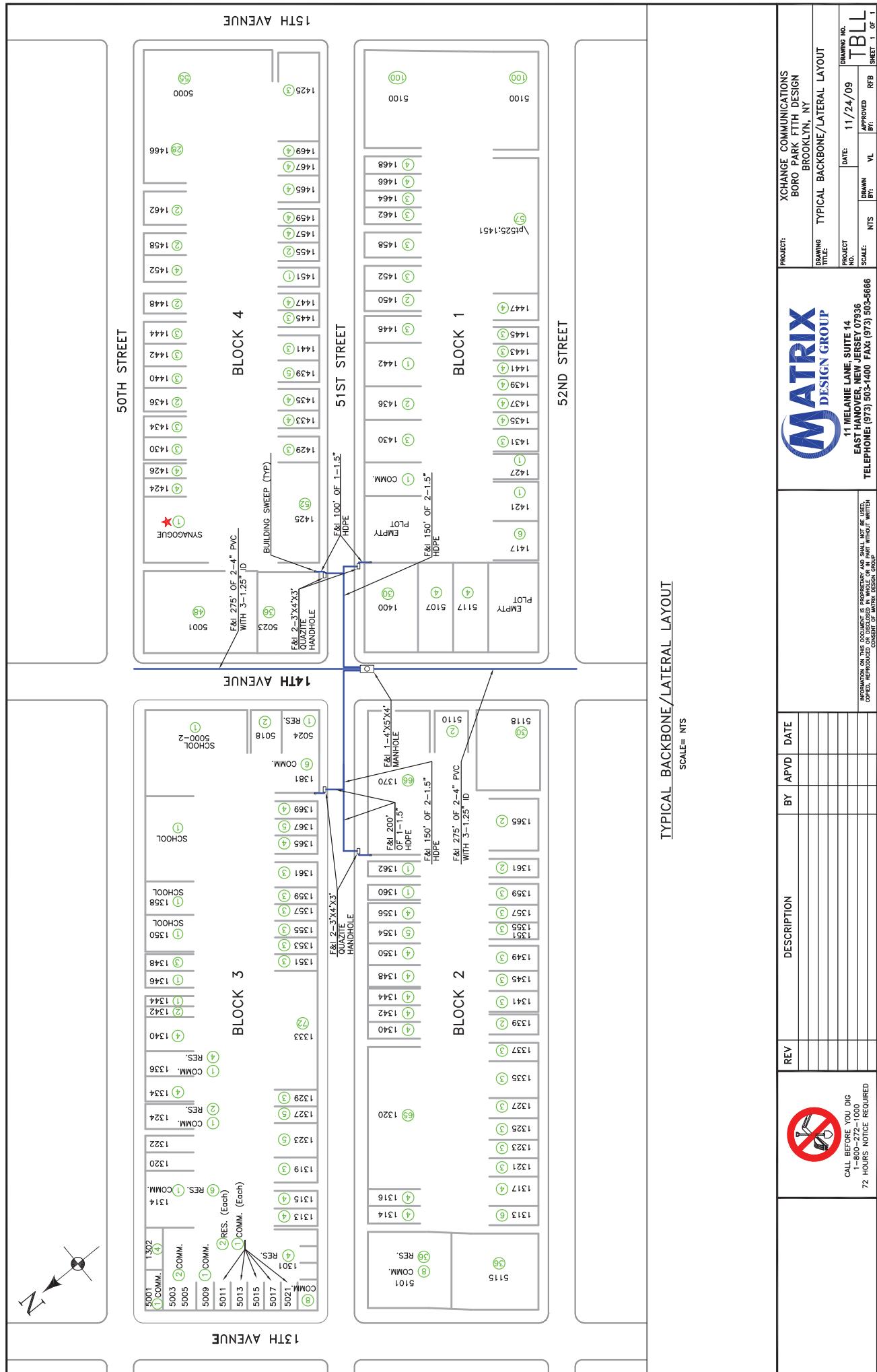
Business Plan Financial Summary Detail

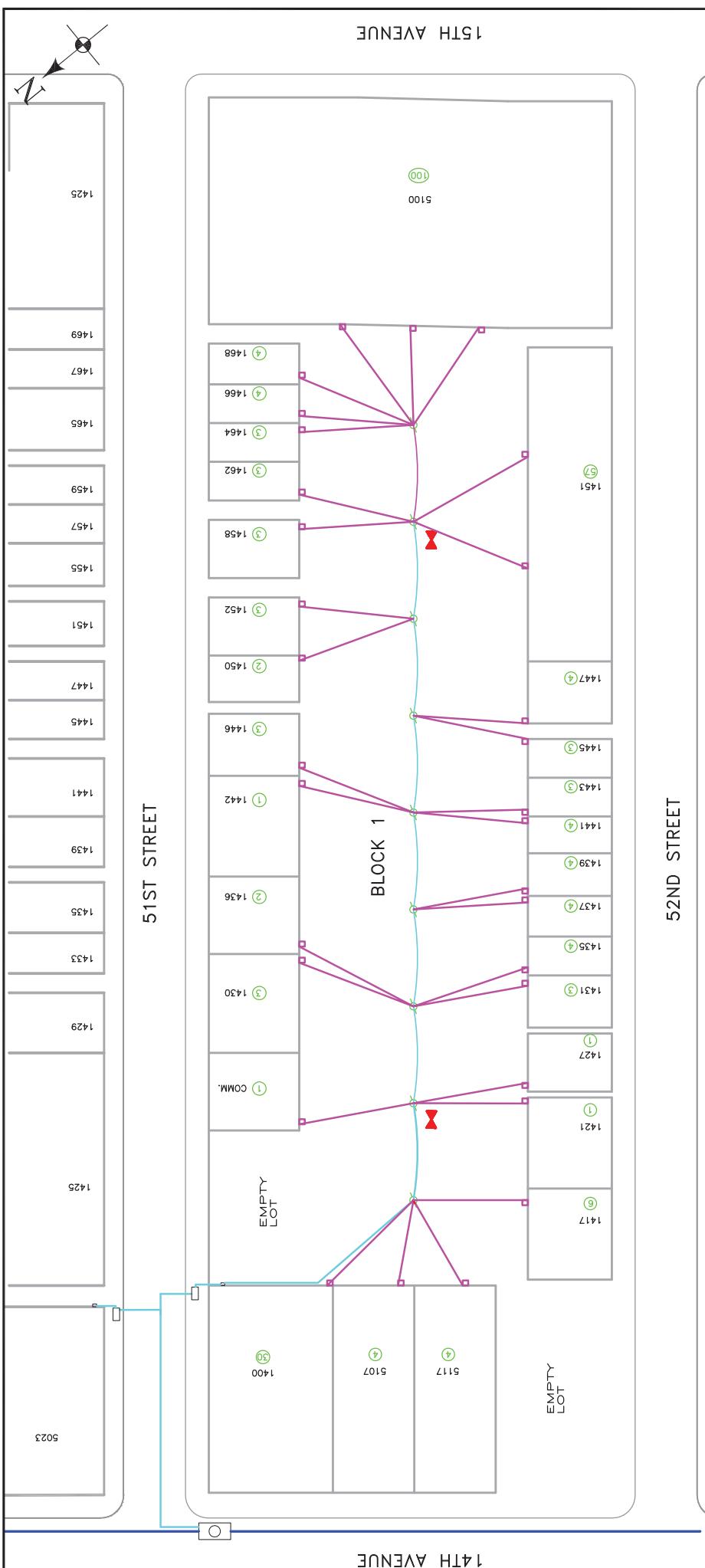
IX. Appendices

- A. Overall Network Map
- B. Typical Backbone/Lateral Layout
- C. Typical Customer Drop Layout
- D. Typical Details
- E. Equipment Specifications

Boro Park - FTTH



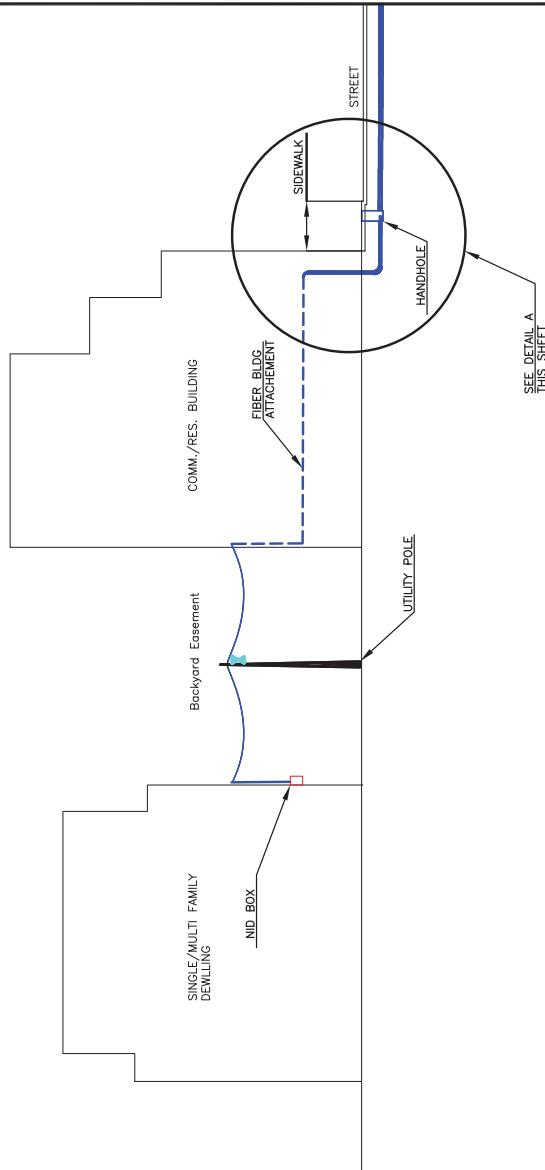




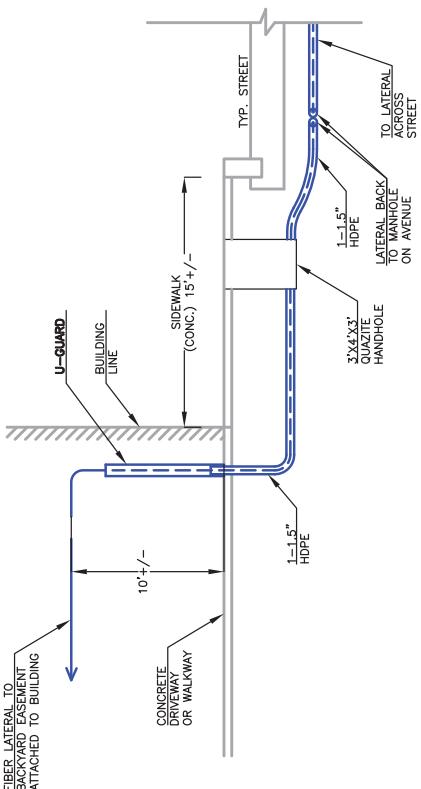
PROPOSED BACKBONE
PROPOSED LATERAL FEED
CUSTOMER DROP
EXISTING POLE
NID/MDF
SPLITTER

UTILITY LEGEND

TYPICAL CUSTOMER DROP LAYOUT



EASEMNET LATERAL FEED DETAIL



DETAIL A

Calix P-Series Product Portfolio

Rev05 August 2009

The information contained in this presentation is
not a commitment, promise or legal obligation to
deliver any material, code or functionality.
The development, release, and timing of any
features or functionality described for our
products remains at our sole discretion.



Calix

ACCESS INNOVATION



700GX SFU ONTs

Calix 700GX ONTs

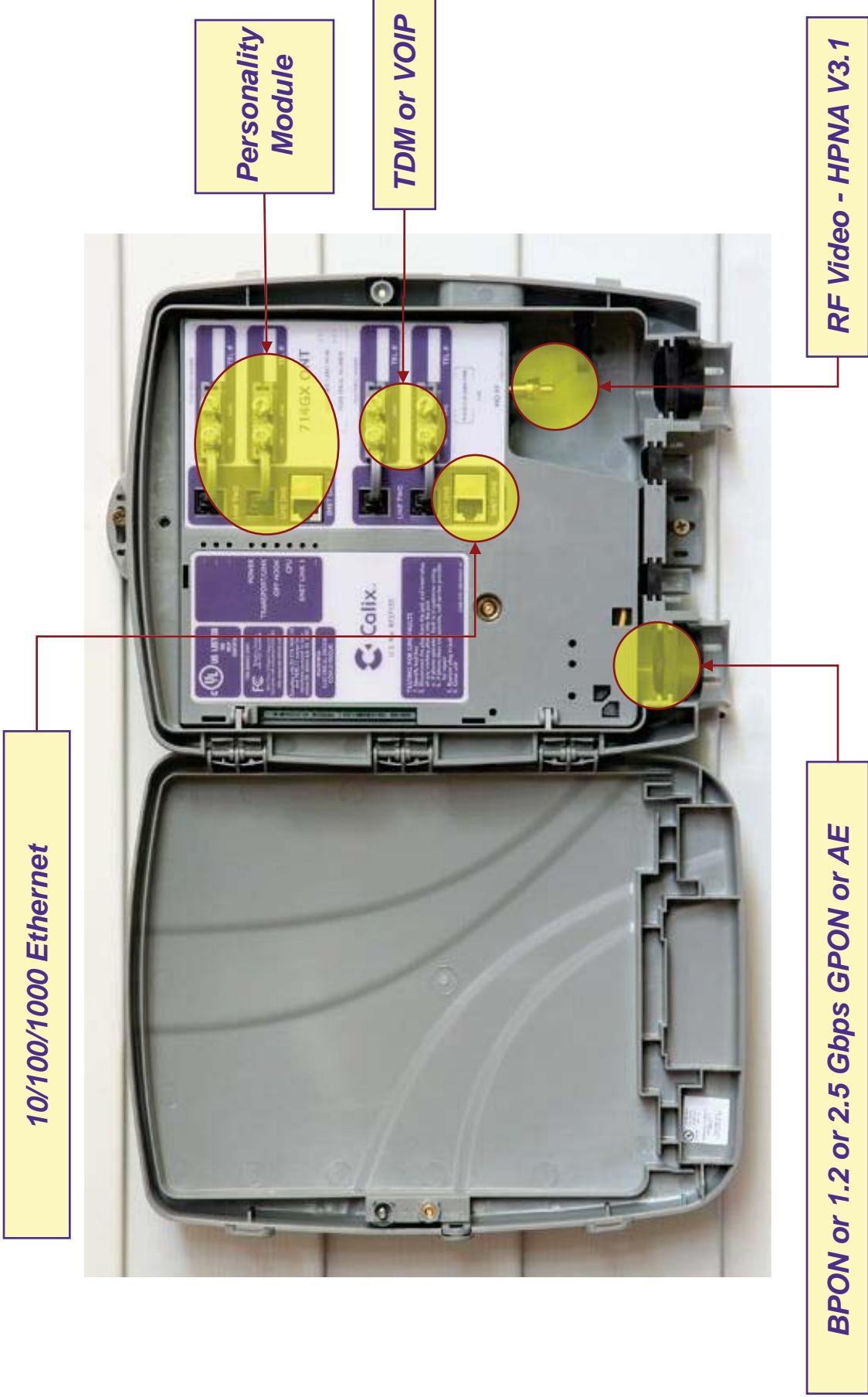
- FSAN GPON Interoperable – AE Capable
 - ▶ Support Class B (25 dB) optical dynamic range for BPON and 1.2 Gbps GPON
 - ▶ Supports Class B+ (28 dB) optical dynamic range for 2.5 Gbps GPON
 - ▶ Supports Active Ethernet – 1 Gbps point-to-point
 - ▶ Auto-detects BPON, GPON or AE modes
- Base Unit
 - ▶ 2 POTS
 - ▶ 1 10/100/1000 Gigabit Ethernet
- Personality and Interface Modules
 - ▶ 2nd independent 10/100 Ethernet port
 - ▶ 2 additional POTS
 - ▶ Integrated HPNA V3.1 adapter
 - ▶ RF video models available



7
00



700GX ONT Service Interfaces





BPON, GPON or AE Auto Detect

POTS	GE/FE	RF Video	Special
710GX ONT	2	1/0	
711GX ONT	2	1/1	
712GX ONT	2	1/0	HPNA V3.1
714GX ONT	4	1/1	
720GX ONT	2	1/0	1 GHz
721GX ONT	2	1/1	1 GHz
722GX ONT	2	1/0	1 GHz
724GX ONT	4	1/1	1 GHz
725GX ONT	2	1/0	1 GHz
740G ONT	2	1/0	2 DS1s



700GX SFU ONT

- ▼ Height: 9.0 in (22.9 cm)
- ▼ Width: 7.9 in (20.1 cm)
- ▼ Depth: 1.0 in (2.5 cm)
- ▼ Unit weight: 1.0 lbs (0.4 kg)
- ▼ 710GX ONT, 2 POTS, 1 GE
- ▼ 711GX ONT, 2 POTS, 1 GE, 1 FE
- ▼ 712GX ONT, 2 POTS, 1 GE, 1 HPNA
- ▼ 714GX ONT, 4 POTS, 1 GE, 1 FE
- ▼ 720GX ONT, 2 POTS, 1 GE, 1 RF (1GHz)
- ▼ 721GX ONT, 2 POTS, 1 GE, 1 FE, 1 RF (1GHz)
- ▼ 722GX ONT, 2 POTS, 1 GE, 1 RF/HPNA (1GHz)
- ▼ 724GX ONT, 4 POTS, 1 GE, 1 FE, 1 RF (1GHz)
- ▼ 725GX ONT, 2 POTS, 1 GE, 1 RF/RF Rtn (1GHz) 100-01483

740G SBU ONTs

- ▼ 2 T1s
- ▼ 740G ONT 2G, 2 POTS, 1 GE, 2 DS1, 1 RF (1GHz) 100-01484

700 ONT Mounting Options



700 ONT Enclosure w/Splice Tray

- ▶ Next generation design
- ▶ Height: 12.0 in (30.5 cm)
- ▶ Width: 10.0 in (25.4 cm)
- ▶ Depth: 4.0 in (10.2 cm)
- ▶ Installed weight (no ONT): 4.0 lbs (1.8 kg)
- ▶ SFU Enclosure w/ Splice Tray: 100-01578

700 ONT Enclosure w/ Splice Tray



700 ONT Enclosure w/OptiTap Adapter

- ▶ Next generation design
- ▶ Height: 12.0 in (30.5 cm)
- ▶ Width: 10.0 in (25.4 cm)
- ▶ Depth: 4.0 in (10.2 cm)
- ▶ Installed weight (no ONT): 4.0 lbs (1.8 kg)
- ▶ SFU Enclosure w/ OptiTap: 100-01579

700 ONT Enclosure w/ OptiTap Adapter



700 ONT Mounting Options



700 ONT Enclosure w/Splice Tray and Primary Protection

- Next generation design
- Primary protectors supports 2 POTS lines
- Height: 12.0 in (30.5 cm)
- Width: 10.0 in (25.4 cm)
- Depth: 4.0 in (10.2 cm)
- Installed weight (no ONT): 4.0 lbs (1.8 kg)
- Splice Tray w/ Protectors option: 100-01580
- OptiTAP w/ Protectors option: 100-01581

700 ONT Enclosure w/ Splice Tray and Primary Protection



700 ONT Mounting Options



700 ONT OptiTap Slack Storage Enclosure

- ▼ Holds 50' of OptiTap cable
- ▼ Mounting holes for 700 ONT Enclosure
- Height: 12.0 in (30.5 cm)
- Width: 10.0 in (25.4 cm)
- Depth: 2.5 in (6.4 cm)
- ▼ Installed weight: 1.5 lbs (0.7 kg)
- ▼ Slack Storage Enclosure: 100-01307

700 ONT Slack Storage Enclosure



**700 ONT Enclosure with 700 ONT
Slack Storage Enclosure**



700 ONT Mounting Options

700 ONT Structured Wiring Enclosure Bracket

- Height: 9.25 inches (23.5 cm)
 - Width: 8.25 inches (21.0 cm)
 - Depth: 1.25 inches (3.2 cm)
 - Unit weight : 10.5 ounces (297 g)
 - 700 ONT SWEB
 - ONT Splice Tray SFU – NG (option)



700 ONT Structured Wiring Enclosure Bracket



ONT Splice Tray SFU - NG (option)



700 ONT Mounting Options



700 ONT Mounting Plate

- ▼ 700 ONT Mounting Plate for 500 ONT Enclosure
- ▼ 700 ONT Mounting Plate:
100-01010

700 ONT in 500 ONT Enclosure

700 ONT Mounting Options



700 ONT in Tellabs 611 Enclosure

700 ONT – Tellabs 610, 611 and Entrisphere Enclosure Bracket

- ▶ T611 - Mounting Bracket: 100-01410



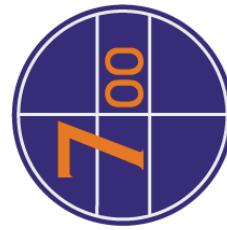
700 ONT in Tellabs 611i Enclosure

700 ONT - Tellabs 611i Enclosure Bracket

- ▶ T611i - Mounting Bracket: 100-01411
- ▶ T611i - Power Cable Adapter Kit 100-01438

761 ONT Enclosure

- Hardened MDU solution
 - 761 ONT Enclosure houses up to four Calix 700 ONT modules
 - Serves up to 8 living units (4 RF video, 8 IPTV)
 - Fed by one to four fibers
 - Economic scalability
 - 12 VDC or -48 VDC models
- Supports 2.5 GPON, BPON and AE
- Housing for splitter module
- Indoor and outdoor applications
- 12 VDC UPS available for indoor applications
- -48 VDC UPS available for outdoor applications
- Both models feature Solar Shields



761 ONT Enclosure - Examples



Supports up to four 700, 700G or 700GX ONTs serving multiple living units - ONT models can be mixed

POTS	GE	RF Video	Special	DS1
4 X 710GX ONT	8	4		
4 X 711GX ONT	8	8		
4 X 712GX ONT	8	4		
4 X 714GX ONT	16	8		
4 X 720GX ONT	8	4	4	
4 X 721GX ONT	8	8	4	
4 X 722GX ONT	8	4	4	
4 X 724GX ONT	16	8	4	
4 X 725GX ONT	8	4	4	4 RF Return
4 X 740G ONT	8	4	4	8

761 ONT Enclosure



761 ONT Enclosure

- Height: 18.5 inches (47.0 cm)
- Width: 13.0 inches (33.0 cm)
- Depth: 10.25 inches (26.0 cm)
- Installed weight (no ONT): 15.0 lbs (6.6 kg)
- Both 761 Enclosures feature Solar Shields
- Indoor UPS - 75W, 12VDC, 20 AH
 - Used with 12V 761
 - Single UPS supports 4 ONT > 4 hours
 - Single UPS supports 2 ONT per GR-909 > 8 hours
 - UPS with battery pack extension supports 4 ONT per GR-909 > 8 hours
- Outdoor UPS - 150W, -48VDC, 57.6 AH
 - Used with -48V 761
 - Single UPS supports 4 ONT per GR-909 > 8 hours
- 761 Encl 12 VDC with Solar Shield: 100-01554
- 761 Encl -48 VDC with Solar Shield: 100-01577
- 761 Enclosure Solar Shield Kit: 100-01293
- 700 ONT OPTITAP KIT SFU 100-01097
- 1x4 Optical Splitter, SC/APC 100-00968

761 ONT Enclosure With 1x4 Optical Splitter

760GX MDU/SBU ONTs

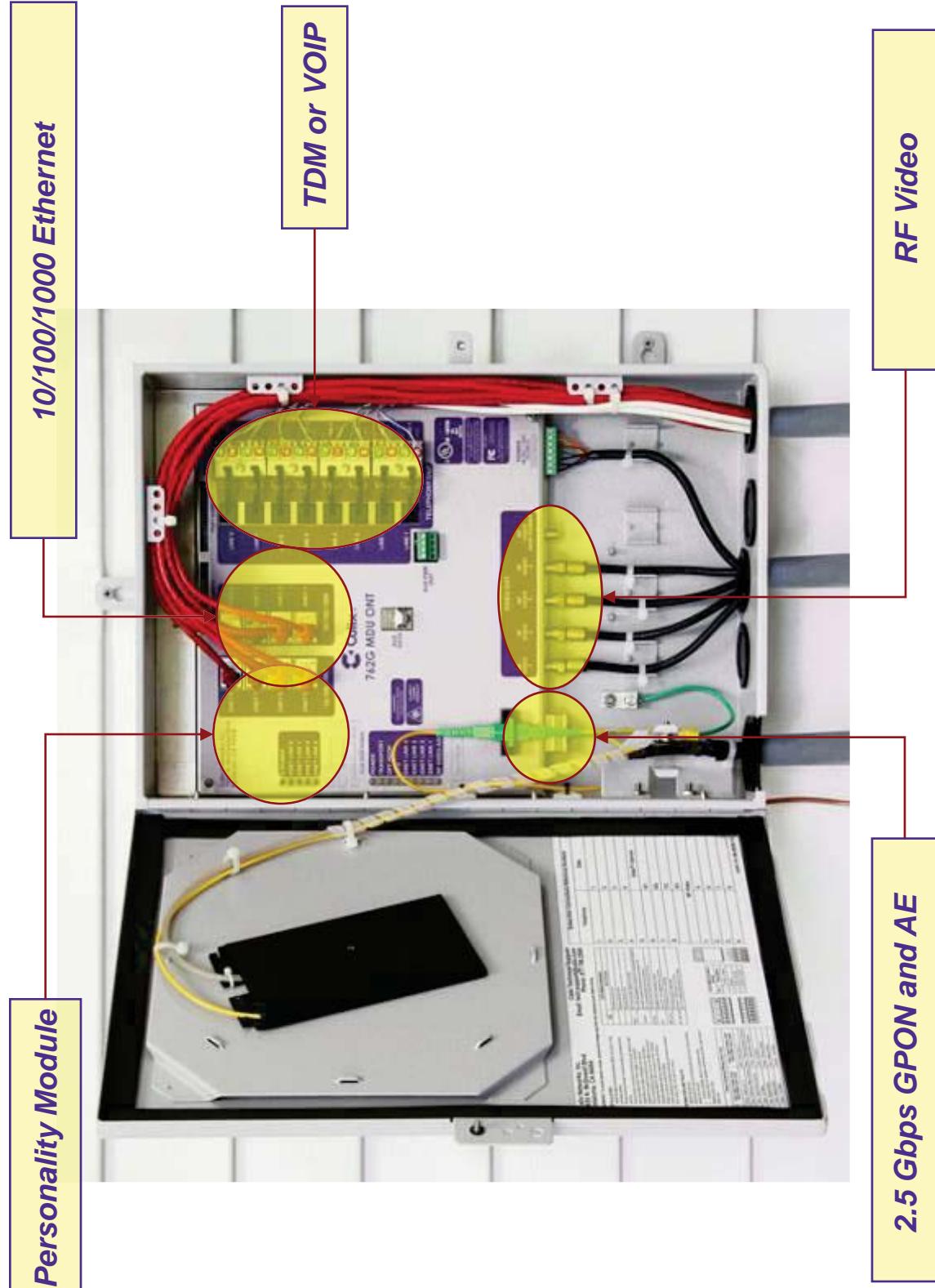
Calix 760GX ONTs

- FSAN GPON Interoperable
 - ▶ Supports Class B+ (28 dB) ODN for 2.5 Gbps GPON
- 760GX ONTs are AE capable
 - ▶ Supports 1 Gbps symmetrical data
- Base Unit
 - ▶ 8 POTS
 - ▶ 4 - 10/100/1000 Gigabit Ethernet ports
 - ▶ 4 - 16 dBmV RF ports
 - ▶ 1 - 33 dBmV RF ports
 - ▶ Auxiliary Power interface
- Personality and Interface Modules
 - ▶ 4 additional 10/100/1000 Gigabit Ethernet ports
 - ▶ 4 DS1 interfaces
 - ▶ 8 DS1 interfaces
 - ▶ 4 additional 16 dBmV RF ports
 - ▶ RF Return
- Optional +24 VDC to -48 VDC converter module



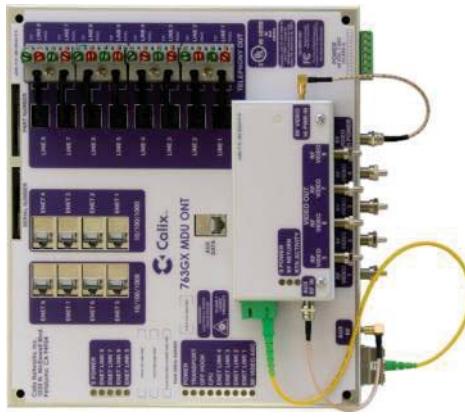


760GX ONT Service Interfaces





760GX MDU/SBU ONTs



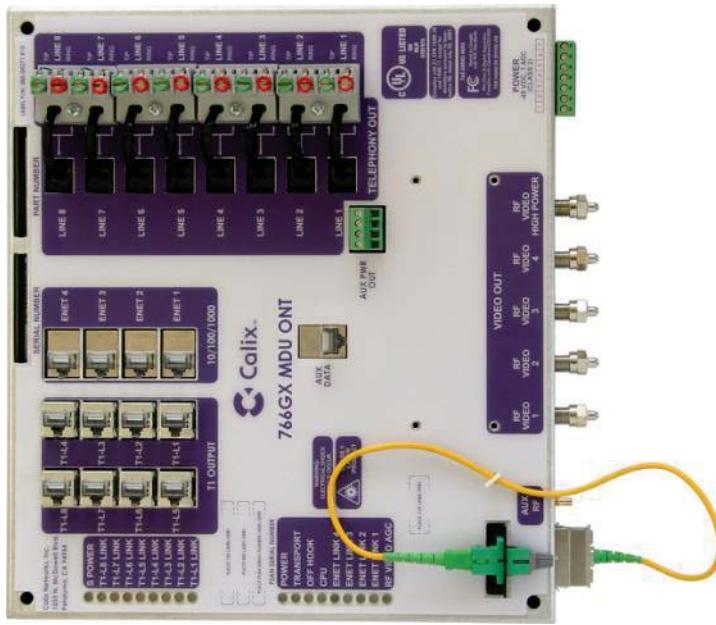
2.5 Gbps GPON and AE Auto Detect



760GX MDU/SBU ONTs

760G and GX MDU/SBU ONTs

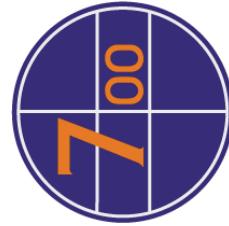
- ▼ Height: 10.5 in (26.9 cm)
- ▼ Width: 11.8 in (30 cm)
- ▼ Depth: 0.9 in (2.3 cm)
- ▼ Unit weight: 3.5 lbs (1.6 kg)
- Indoor UPS - 50 W, -48 VDC, 20 AH
 - ▼ Single UPS supports 1 ONT per GR-909 > 8 hrs
 - ▼ Outdoor UPS – 50 W, -48 VDC, 28.8 AH
 - ▼ Single UPS supports 1 ONT per GR-909 > 8 hrs
 - ▼ Outdoor UPS - 150 W, -48 VDC, 57.6 AH
 - ▼ Single UPS supports 1 or 2 ONT per GR-909 > 8 hrs
- ▼ +24 VDC plug-in module available
- ▼ 765G ONT 2G, 8 POTS, 4 GE, 4 DS1, 4 RF w 1 XRF (1 GHz)
 - ▼ 760GX ONT, 8 POTS, 4 GE, 4 RF w 1 XRF (1GHz) 100-01485
 - ▼ 762GX ONT, 8 POTS, 8 GE, 4 RF w 1 XRF (1GHz) 100-01486
 - ▼ 763GX ONT, 8 POTS, 8 GE, 8 RF w RF Rtn (1GHz) 100-01550
 - ▼ 766GX ONT, 8 POTS, 4 GE, 8 DS1, 4 RF w 1 XRF (1GHz) 100-01551



766GX ONT

Calix 760GX-R Rack-Mount ONTs

- FSAN GPON Interoperable
 - ▶ Supports Class B+ (28 dB) ODN for 2.5 Gbps GPON
- 760GX-R ONTs are AE capable
- Supports 1 Gbps symmetrical data
- Base Unit
 - ▶ 8 POTS
 - ▶ 4 - 10/100/1000 Gigabit Ethernet ports
 - ▶ 4 - 16 dBmV RF ports
 - ▶ 1 - 33 dBmV RF ports
 - ▶ Auxiliary Power interface
- Personality and Interface Modules
 - ▶ 4 additional 10/100/1000 Gigabit Ethernet ports
 - ▶ 4 DS1 interfaces
 - ▶ 8 DS1 interfaces
 - ▶ 4 additional 16 dBmV RF ports
 - ▶ RF Return
- Two +24 VDC rack-mount models





760GX Rack-Mount ONTs



760GX-R Rack-Mount MDU ONTs

POTS	GE	RF Video	Special	DS1	
8	8	8	8	8	RF Return
763GX-R ONT					

760G and GX-R Rack-Mount SBU ONTs

765G-R ONT	8	4	4 + 1	4 TDM
765G-R-24 ONT	8	4	4 + 1	+24 VDC
766GX-R ONT	8	4	4 + 1	8 TDM + PWE3
766GX-R-24 ONT	8	4	4 + 1	8 TDM + PWE3
767GX-R ONT	8	4	8	RF Return

760GX-R Rack Mount ONTs



760GX-R Rack Mount MDU/SBU ONTs

- ▶ MDU and SBU models
- ▶ -48 and +24 VDC versions
- ▶ Height: 2.6 inches (6.6 cm)
- ▶ Width: 19- or 23-inch rack mount
 - ▶ *Mid-mount and flush mount options*
- ▶ Depth: 16.0 in (40.6 cm)
- ▶ Installed weight: 6.7 lbs (3.0 kg)
- ▶ 765G-R Rack Mount ONT(1GHz) 100-01691
- ▶ 765GX-R-24 Rack Mount ONT(1GHz) 100-01800
- ▶ 763GX-R Rack Mount ONT 100-01751
- ▶ 766GX-R Rack Mount ONT 100-01693
- ▶ 766GX-R-24 Rack Mount ONT 100-01694
- ▶ 767GX-R Rack Mount ONT 100-01752

766GX-R Rack Mount ONT

760 ONT Mounting Options



760 ONT Enclosure w/Splice Tray

- ▼ Height: 18.5 inches (47.0 cm)
- ▼ Width: 13.0 inches (33.0 cm)
- ▼ Depth: 4.75 in (12.1 cm)
- ▼ Installed weight (no ONT): 6.0 lbs (2.6 kg)
- 760 ONT Enclosure: 100-01299
- 700 ONT OPTITAP KIT SFU 100-01097

760 ONT Enclosure



760 ONT Structured Wiring Enclosure Bracket

- ▼ Height: 13.5 in (34.3 cm)
- ▼ Width: 11.9 in (30.2 cm)
- ▼ Depth: 2.0 in (5.1 cm)
- ▼ Unit weight: 1.3 lbs (0.6 kg)
- 760 ONT SWEB: 100-01519
- 700 ONT Splice Tray (option) 100-01582

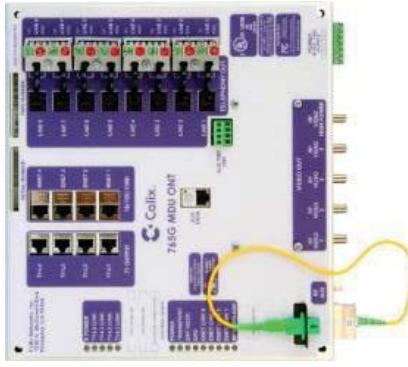
760 ONT Structured Wiring Enclosure Bracket

MDU 6-I ONT Enclosure

- Indoor MDU solution
 - ▶ MDU 6-I ONT Enclosure houses up to six Calix 760 MDU ONT modules
 - ▶ Serves up to 48 living units (RF video or IPTV)
 - ▶ Fed by six fibers
 - ▶ Economic scalability
 - ▶ -48 VDC powered
- Supports 2.5 GPON, BPON and AE
- Indoor applications
 - ▶ Multiple -48 VDC UPS power sources available



MDU 6-I Enclosure Examples



Supports up to six 760GX ONTs serving multiple living units - ONT types can be mixed

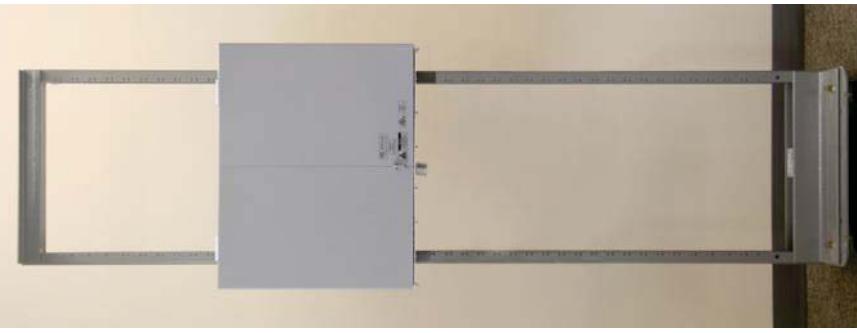
760GX MDU and SBU ONTs

POTS	GE	RF Video	Special	DS1
6 x 760GX ONT	48	24	24 + 6	
6 x 762GX ONT	48	48	24 + 6	
6 x 765G ONT	48	24	24 + 6	24 TDM

760GX MDU and SBU ONTs

6 x 763GX ONT	48	48	48	RF Return
6 x 766GX ONT	48	24	24 + 6	48 TDM + PWE3

760 ONT Mounting Options



**MDU 6-1 ONT Enclosure
Rack Mount**

MDU 6-1 ONT Enclosure

- ▼ Height: 21.0 inches (53.3 cm)
- ▼ Width: 24.0 inches (61.0 cm)
- ▼ Depth: 15.0 inches (38.1 cm)
- ▼ Installed weight (no ONTs): 14.0 lbs (6.4 kg)
- ▼ MDU 6-1 ONT Enclosure: 100-01609

ONT Powering Options

The information contained in this presentation is
not a commitment, promise or legal obligation to
deliver any material, code or functionality.
The development, release, and timing of any
features or functionality described for our
products remains at our sole discretion.



Calix

ACCESS INNOVATION

SFU UPS Powering Options

Indoor 24 W, 12 VDC UPS

- ▼ CyberPower 24 W, 12 VDC, 7.2 AH unit
- ▼ 6.25" x 9.25" x 3.5" (HxWxD)
- ▼ Installed weight: 7.3 lbs (3.3 kg)
- ▼ 3-year warranty
- ▼ Supports one 700G ONT
- ▼ Indoor SFU 7.2 AH UPS:
- ▼ Indoor SFU with Ex. Life Battery:
- ▼ Indoor SFU without battery:



Outdoor 24 W, 12 VDC UPS

- ▼ CyberPower 24 W, 12 VDC, 7.2 AH unit
- ▼ 8" x 10.75" x 3.75" (HxWxD)
- ▼ Installed weight: 7.7 lbs (3.5 kg)
- ▼ 3-year warranty
- ▼ Supports one 700G ONT
- ▼ -40° F to 131° F
- ▼ Outdoor SFU 7.2 AH UPS:



Indoor 30 W, 12 VDC UPS

- ▼ CyberPower 30 W, 12 VDC, 20 AH unit
- ▼ 11" x 11.75" x 4" (HxWxD)
- ▼ Installed weight: 17 lbs (7.7 kg)
- ▼ 3-year warranty
- ▼ Supports one 700G ONT
- ▼ Extended backup time
- ▼ Indoor SFU 20 AH UPS:



MDU UPS Indoor Powering Options



Indoor 75W, 12 VDC UPS

- ▼ CyberPower 75 W, 12 VDC, 20 AH unit, regulated output
- ▼ 11" x 11.75" x 4" (HxWxD)
- ▼ Installed weight: 18 lbs (8.2 kg)
- ▼ 3-year warranty
- ▼ Supports one 761 ONT Enclosure
- ▼ Indoor 75W MDU 20 AH UPS: 100-01408



Indoor 50W, -48 VDC UPS

- ▼ CyberPower 50 W, -48 VDC, 20 AH unit
- ▼ 11" x 11.75" x 4" (HxWxD)
- ▼ Installed weight: 17.5 lbs (8.0 kg)
- ▼ 3-year warranty
- ▼ Supports one 760G ONT
- ▼ Indoor 50W MDU 20 AH UPS: 100-00746



Indoor Auxiliary Battery Backup

- ▼ CyberPower 20 AH unit
- ▼ Supports all CyberPower Indoor UPS units
- ▼ 11" x 11.75" x 4" (HxWxD)
- ▼ Installed weight: 17 lbs (7.7 kg)
- ▼ 3-year warranty
- ▼ Indoor battery backup: 100-00747

MDU UPS Outdoor Powering Options



Outdoor 50W, -48 VDC UPS

- ▶ Alpha 50 W, -48 VDC, 28.8 AH unit, regulated output
- ▶ 17.5" x 12.75" x 5.25" (HxWxD)
- ▶ Installed weight: 34.6 lbs (15.7 kg)
- ▶ Optional batter heaters, 120 VAC or 240 VAC
- ▶ 3-year warranty
- ▶ Supports one 760G ONT
- ▶ Outdoor 50W MDU UPS:
 - ▶ Battery Heater, 120 VAC
 - ▶ Battery Heater, 240 VAC



Outdoor 150W, -48 VDC UPS

- ▶ Alpha 150 W, -48 VDC, 57.6 AH unit, regulated output
- ▶ 14" x 23.75" x 5.5" (HxWxD)
- ▶ Installed weight: 72.2 lbs (32.8 kg)
- ▶ 3-year warranty
- ▶ Supports one or two 760G ONTs
- ▶ Supports one or two 761 ONT Enclosures
- ▶ Includes battery heater
- ▶ Outdoor 150W MDU UPS:
 - ▶ 100-01341



760 24 VDC Power Converter Module

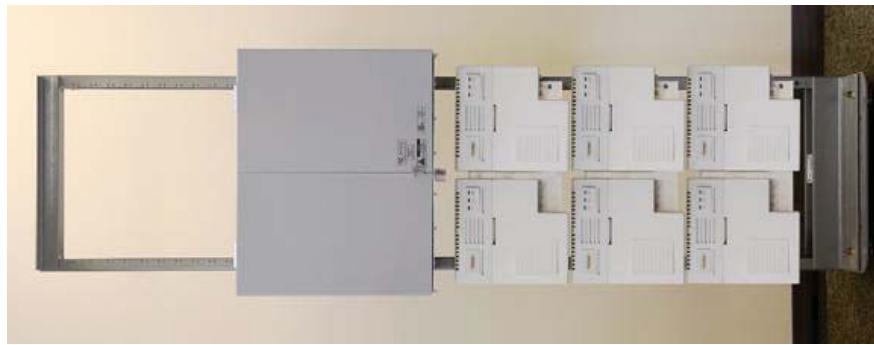


760 24VDC Power Converter Module

- Converts +24 VDC to -48 VDC
- Plugs into 760G or GX ONT modules
- 760 24VDC PCM

100-01779

MDU 6-I Powering Options



MDU 6-I ONT Enclosure

- Each ONT powered by one 50 W, -48 VDC UPS

Indoor 50W, -48 VDC UPS

- CyberPower 50 W, -48 VDC, 20 AH unit
- 11" x 11.75" x 4" (HxWxD)
- 3-year warranty
- Supports one 760G ONT
- Indoor 50W MDU 20 AH UPS: 100-00746

**MDU 6-I ONT Enclosure with
Individual ONT Power Supplies**

MDU 6-I Powering Options



MDU 6-I ONT Enclosure Power Supply

- ▼ Up to six 760 ONTs powered by one 350 W, -48 VDC rectifier w/battery backup

Eltek Valere 7 A, 350 W, -48 VDC Rectifier w/Battery Backup

Kit Includes:

- ▼ Rectifier and distribution enclosure (2 RU)
- ▼ Battery enclosure for four, 40 or 33 AH batteries (6 RU)
- ▼ 40 AH Battery String (four 12 V batteries)
- ▼ One 7 Amp rectifier; optional second rectifier module available for power redundancy
- ▼ ONT power distribution and alarms cable harness
- ▼ One 10 Amp GMT fuse
- ▼ Supports up to six 760G ONTs
- MDU 6-I Power System and Cable Kit: 000-00319
- MDU Rectifier Module 7A (for redundancy) 100-01564

MDU 6-I ONT Enclosure with Eltek Valere Power Supply



UPS Outdoor Powering Options



Calix UPS Outdoor Meter Collar

- Provides fused 110 AC power from electric meter
- Powers SFU and MDU UPSs
- 2' Power cable
- UPS Outdoor Meter Collar: 100-00721

Calix UPS Outdoor Meter Collar

Calix Type I 18/22 AWG Composite Cable

- ▼ 1000' spool
- ▼ 700 ONT SFU: 50' support
- ▼ 761 ONT Enclosure: 40' support
- ▼ 760 ONT MDU: 100' support
- ▼ Calix Type I Cable: 100-00988

**Calix Type II 16/24 AWG Composite Cable**

- ▼ 1000' spool
- ▼ 700 ONT SFU: 70' support
- ▼ 761 ONT Enclosure: 60' support
- ▼ 760 ONT MDU: 100' support
- ▼ Calix Type II Cable: 100-01314

**Calix Type III 12/24 AWG Composite Cable**

- ▼ 100' loose coil, individual package
- ▼ 700 ONT SFU: 100' support
- ▼ 761 ONT Enclosure: 100' support
- ▼ 760 ONT MDU: 100' support
- ▼ Calix Type III Cable: 100-01333



700 and 760 ONT Accessories

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features or functionality described for our
products remains at our sole discretion.



Calix

ACCESS INNOVATION

ONT Security Key Tools



ONT Security Key – Screw Driver Tool

- ▼ 5/32" security pin hex bit
- ▼ ONT power connector screw driver, 3/32" standard blade
- ▼ Supports 700 ONT Enclosure door and power connector
- ▼ Supports 760 ONT Enclosure door and power connector
- ▼ Supports 761 ONT Enclosure door and power connector
- ▼ ONT Security Key - Screwdriver: 100-01608

ONT Security Key – Screw Driver Tool



ONT Security Key Tool

- ▼ 5/32" security pin hex bit
- ▼ Supports 3/8" and 7/16" hex nuts
- ▼ Supports 700 ONT Enclosure door and grounding
- ▼ Supports 760 ONT Enclosure door and grounding
- ▼ Supports 761 ONT Enclosure door and grounding
- ▼ ONT Security Tool: 100-00714

ONT Security Tool

ONT Splice Trays



700 ONT Splice Tray SFU – NG

- ▼ Option for 700 SWEB
- ▼ ONT Splice Tray SFU – NG: 100-01582

700 ONT Splice Tray SFU - NG



760 ONT Splice Tray

- ▼ Replacement for 761 ONT Enclosure
- ▼ Replacement for 760 ONT Enclosure
- ▼ Option for indoor ONT installations
- ▼ ONT Splice Tray MDU: 100-01499

760 ONT Splice Tray MDU

Fiber Jumpers and Pigtails



Fiber Jumper

- ▼ SC/APC to SC/APC connectors
- ▼ 1 meter long
- ▼ Fiber Jumper SC/APC to SC/APC, 1m: 100-01655

Fiber Jumper SC/APC to SC/APC



Fiber Pigtail

- ▼ SC/APC to non-terminated fiber
- ▼ 0.8 m long, optimized for ONT Splice Tray SFU
- ▼ Fiber Pigtail SC/APC: 100-01142

Fiber Pigtail

Optical Attenuators



Optical Attenuator – SC/APC M-F

- ▼ SC/APC M-F Plug
- ▼ 3 dB, 5 dB and 10 dB attenuators
- ▼ Optical Attenuator – 3 dB SC/APC M-F Plug: 100-01689
- ▼ Optical Attenuator – 5 dB SC/APC M-F Plug: 100-01642
- ▼ Optical Attenuator – 10 dB SC/APC M-F Plug: 100-01643

Optical Attenuator – SC/APC M-F



Optical Attenuator – LC/UPC M-F

- ▼ LC/UPC M-F Plug
- ▼ 3 dB, 5 dB and 10 dB attenuators
- ▼ Optical Attenuator – 3 dB LC/UPC M-F Plug: 100-01688
- ▼ Optical Attenuator – 5 dB LC/UPC M-F Plug: 100-01657
- ▼ Optical Attenuator – 10 dB LC/UPC M-F Plug: 100-01658

Optical Attenuator – LC/UPC M-F

700 ONT OptiTap Adaptor Kit



700 ONT OptiTap Adaptor Kit

- ▼ Used for conversion of 700 ONT Enclosure w/ splice tray to ONT Enclosure with OptiTap
- ▼ Option for 760 ONT Enclosure for OptiTap applications
- ▼ 700 ONT OptiTap Adaptor 100-01097

700 ONT OptiTap Adaptor Kit

700 ONT Power Connectors



700 ONT 7-Position Power Connector

- ▶ Replacement 7-Position Power Connector – 20 quantity
- ▶ Power Connector 700 ONT 120-00084

700 ONT Power Connector



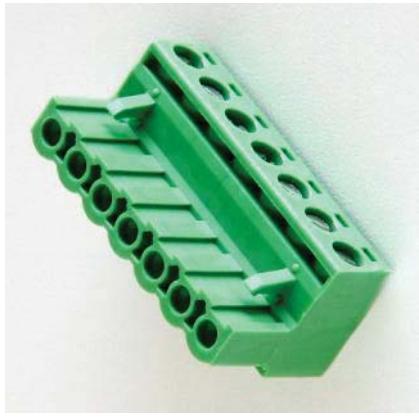
CyberPower UPS 7-Position Power Connector

- ▶ Replacement 7-Position Power Connector – 25 quantity
- ▶ Power Connector CyberPower UPS 120-00108

CyberPower UPS Power Connector



760 ONT Power Connector



760 ONT 7-Position Power Connector

- Replacement 7-Position Power Connector – 20 quantity
- Power Connector 760 ONT 120-00130

760 ONT Power Connector

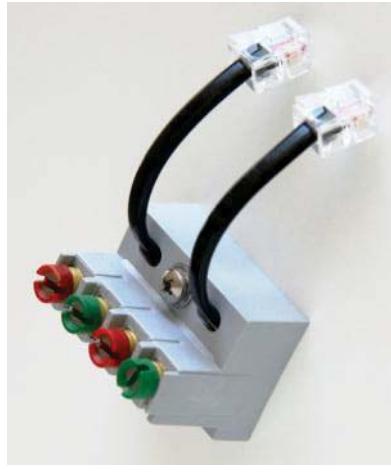
700 ONT Binding Posts



700 SFU ONT Binding Post

- ▼ Replacement Binding Post – 20 quantity
- ▼ Binding Post 700 ONT: 120-00089

700 SFU ONT Binding Post



760 ONT Binding Post

- ▼ Replacement Binding Post – 4 quantity
- ▼ Binding Post 760 ONT: 120-00131

760 ONT Binding Post

Cable Clamp and Ground Lug



700 ONT Cable Clamp

700 ONT Enclosure Cable Clamp

- ▶ Option item, supports dielectric flat fiber
- ▶ Attaches to current 700 ONT Enclosure ground bracket
- ▶ Sold in package of 20 clamps
- ▶ 700 ONT Cable Clamp – Qty 20 100-01531



700 ONT Ground Lug

700 ONT Ground Lug

- ▶ Ground adapter for 700 ONT, used for indoor installations
- ▶ Not required for 700 ONT Enclosure
- ▶ 700 ONT Ground Lug 100-01012

700 ONT Enclosure Grommets



700 ONT Enclosure – Large Grommet

- ▼ Replacement Large Grommet – 20 quantity
- ▼ Large Grommet 700 Enclosure: 120-00088

700 ONT Enclosure Large Grommet



700 and 500 ONT Enclosure – Small Grommet

- ▼ Replacement Small Grommet – 20 quantity
- ▼ Small Grommet 700 and 500 Enclosure: 120-00085

700 and 500 ONT Enclosure Small Grommet

Thank you

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Calix

ACCESS INNOVATION

» EG10W Features

- Ethernet Gateway with 3-Port Ethernet Switch and WiFi
- Deployable Behind Fiber ONTs, Cable Modems, DSL Gateways, WiMax Access Points, and Satellite CPEs
- Interoperable with Leading BLCs

» Built-in Support For

- Connect and Surf™
- TR-069 Device Management
- Advanced Data Services
 - Managed WiFi
 - Managed Firewall
 - Content Filtering (Parental Controls)
 - Internet Time Blocking

» Why ClearVision?

- Fewer truck rolls & shorter support calls
- Better managed IPTV deployments
- New incremental service revenues
- Increased customer satisfaction and retention
- Multi-vendor device management

ClearAccess EG10W Ethernet Gateway

The **ClearAccess EG10W** is a robust 3-port gateway with WiFi that enables the delivery of advanced features and services over IP-based Ethernet networks.

This is no ordinary Ethernet gateway with WiFi. The EG10W will provide you with outstanding data transfer speeds, and when paired with the ClearVision Management System you will see fewer truck rolls, shorter support calls, and new service revenues.



Connect and Surf™ eliminates gateway preprovisioning of network parameters (e.g. VLANs) and subscriber credentials (e.g. PPPoE) while greatly simplifying IPTV deployments. For example, by leveraging ClearVision's TR-069 management capabilities you are able to remotely configure Ethernet ports on the gateway to accommodate any number of IPTV set-top boxes offering greater deployment flexibility.

The EG10W also enables a variety of Advanced Data Services (e.g. Managed WiFi, Managed Firewall, Content Filtering, and Internet Time Blocking) allowing you to increase profitability through new service revenues. The EG10W is certified to interoperate with leading BLC vendors.



The ClearAccess Advantage

- Truck rolls and support calls are minimized as gateway activation, configuration, troubleshooting, and maintenance are performed remotely by ClearVision.
- Bulk CPE configuration changes, remote firmware upgrades, and a wealth of new management tools and reporting information enable you to be proactive and maintain a well-tuned, future-proof broadband network.
- ClearAccess Advanced Data Services enable you to easily deploy new revenue generating data services without overburdening your support team. In a matter of seconds either the subscriber or support personnel can setup and manage the various services as required.

Routing Features

- RIP1 (RFC 1058), RIP2 (RFC 1389) and Static Routing
- NAT, NAPT and Extensive ALG Support
- DHCP Client and Server
- DNS Relay
- IGMP Proxy
- DMZ Host Support
- Port Forwarding and Triggering
- SIP Traversal
- IPSec Tunneling
- VPN Support
- Dynamic DNS

Physical Specifications

- Dims (in): 6.7 (w) x 5.3 (l) x 1.6 (h)
- Dims (mm): 170 (w) x 135 (l) x 40 (h)

Environment Operating Temp:

- 0°C to 40°C
- Humidity: 10% - 95% (non-condensing)

Security

- Stateful Packet Inspection Firewall
- Configurable Firewall Function
- Local and Trusted Certificate Verification
- IP/URL/Port/MAC Filtering
- Supports PAP and CHAP with PPP (RFC 1334)

WAN Protocols

- Direct IP (Static)
- Direct IP (DHCP)
- PPPoE (RFC 2516)

Wireless LAN

- 802.11b/g wireless access point
- Encryption: WEP, WPA-PSK, WPA2, WPA2-PSK, Mixed WPA2/WPA-PSK
- MAC addressed-based access control
- Modulation: DSSS (b); OFDM (g)
- Channels: 11 (US/Can), 13 (ETSI)
- Wireless Distribution System (WDS)
- Output Power: > 15dBm

Remote Management

- TR-069 Device Management
- TR-098 Gateway Device Model
- TR-106 Generic Device Model
- TR-111 LAN Device Management
- Automatic Subscriber Activation
- Real-time Status and Reporting
- Firmware Flash, Restore, and Upgrade
- SNMP, Telnet, HTTP, FTP and TFTP
- Configuration Backup and Restore
- On-demand, Value-added Service Provisioning (e.g. VoIP, IPTV, etc.)

Physical Interfaces

- One (1) Ethernet WAN port (RJ-45)
- Three (3) 10/100 Ethernet LAN Ports (RJ-45) with Auto-detection
- One (1) External Antenna
- Built-in Wall Mounting Keyholes

SeeMore. DoMore. BeMore.™



Your NGN CPE Solution Provider



Cable Replacement
Plug & Play with Phone lines
A Compact HomePNA 3.0 LAN Adapter
Providing powerful Broadband connection
128Mbps Data Rate

Product Features...

- 128Mbps HomePNA port as Home Network Backbone by using existing phonelines
- Two 10/100M Fast Ethernet ports for FTTH, DSL/Cable Modem, and Ethernet Terminals. Such as, PC, STB,...etc
- Distance up to 2000 Feet on HomePNA Port
- Filter Built-In to eliminate noise from phone sets or PSTN Line
- QoS Priority and Mapping supports
- Plug & Play
- Compact Size Design

HPPE-322

(Part Number: 555-HPPE-322)

Alpha Telecom HomePNA 3.0 Ethernet Bridge,

HPPE-322, Enables you to setup your private network at home with your existing Telephone lines.

No additional network wiring is necessary. You might just find a RJ-11 phone jack in the wall, put the phoneline and plug into the jack. You can then be ready to access Broadband Internet networks.

No extra Utility, no setting is needed. Just link to Plug & Play.

Via the RJ-45 Ethernet port, you can connect HPPE-322 with the Ethernet-Interfaced devices such as STB (Set Top Box), Camera Server, or Switch/Hub. The high speed of 128Mbps will bring you to enjoy the Video-On-Demand (VOD) or Multimedia-On Demand (MOD) services.

With HPPE-322, SOHO can even quickly extend or flexibly change the existing LAN environment. Reducing most rewiring works.

HomePNA 3.0 Ethernet Adapter

TECHNICAL SPECIFICATIONS

Network Standards

- HomePNA 3.0
- ITU-T G.9954
- IEEE 802.3
- IEEE 802.3u
- IEEE 802.3x

Connectors

- Ethernet: Two RJ-45 Ports
- HomePNA: Two RJ-11 Ports
 - One for HPNA
 - The other for Phoneline Bypass

Fast Ethernet Interface

- 10/100Mbps
- MDI/MDIX Auto Crossover

Indicators

- "Power" LED
- Ethernet "Link/Activity" LED x 2
- HPNA "Link/Activity" LED x 2
- "SyncMode" LED

Transmission Speed

- Up to 128Mbps

Environments

- Operating Temperature: 0 ~ 40°C (32°F ~ 104°F)
- Storage Temperature: -10 ~ 65°C (14°F ~ 149°F)
- Humidity: 10~95% (non-condensing)

Order Part Number: 555-HPPE-322

Alpha Telecom, Inc. USA

USA Headquarters
1362 Borregas Avenue
Sunnyvale, California 94089-1004
TEL: (408) 541-6188
FAX: (408) 734-8994
Website: <http://www.alpha-tele.com>

QoS (Quality of Service)

- Tag VLAN Pass Through
- Priority Mapping based on 802.1P
- Priority Queue based on 802.1P, ToS, and DiffServ
- UPnP support
- DSL Forum TR-069 and TR-064

Power Requirements

- External power Supply: 5VDC
- Consumption < 5Watts

EMI/EMC

- FCC
- CE
- VCCI

Approval and Safety

- FCC Part 68
- UL/cUL, CSA, EN60950

Dimension and Weight

- W x D x H: 114 x 67 x 25 (mm)
- 105g



HPPE-322 Application Diagram

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GPON CLASS B+ CALCULATOR

COMPONENT LOSS VARIABLES

Calix Specification GPON Loss	Qty	U/M	Unit Loss (typ.)	Total Loss	σ^2	3σ
Splitter(1X2) - connectorized	1	ea	3.70	3.70	0.0121	0.33
Splitter(1X3) - connectorized	0	ea	5.10	0.00	0.0000	0.40
Splitter(1X4) - connectorized	0	ea	7.25	0.00	0.0000	0.45
Splitter(1X8) - connectorized	0	ea	10.38	0.00	0.0000	0.63
Splitter(1X16) - connectorized	0	ea	14.10	0.00	0.0000	0.90
Splitter(1X32) - connectorized	1	ea	17.00	17.00	0.1736	1.25
Fiber Length (mi)	6	mi	0.42	2.51	0.0043	0.08
ONT Connector	1	ea	0.40	0.40	0.0044	0.20
OSP Connectors (APC)	3	ea	0.25	0.75	0.0133	0.20
Splices	4	ea	0.05	0.20	0.0002	0.02
OLT Combiner (Only with VPON)	No		0.80	0.00	0.0000	0.00
Required Design Margin (dB)	1		1.0			1.0

ODN Loss - BOL

Downstream Mean	3σ	Mean+3 σ	Mean-3 σ
24.6	1.37	25.9	23.2

Laser Power Calculation

Laser Launch Power Minimum

Minimum	Nominal	Maximum
1.5	1.5	1.5 dBm

Link Budget Calculation - EOL

Laser Output

PON Loss

Received Power Limits [Max | Mean | Min]

Receiver Sensitivity (BER = 1E-10)

Optical Link Margin

Downstream Margin (dB) Mean	Mean-3 σ	Mean+3 σ
5.3	3.9	1.6

Dynamic Range Limit	Maximum Loss on the PON	27.3
	Minimum Allowed Loss on the PON	13.0

Every ONT must have at least this much optical loss.

DOWNSTREAM LOSS - 1490nm

Unit Loss (typ.)	Total Loss	σ^2	3σ
3.70	3.70	0.0121	0.33
5.10	0.00	0.0000	0.40
7.25	0.00	0.0000	0.45
10.38	0.00	0.0000	0.63
14.10	0.00	0.0000	0.90
17.00	17.00	0.1736	1.25
0.42	2.51	0.0043	0.08
0.40	0.40	0.0044	0.20
0.25	0.75	0.0133	0.20
0.05	0.20	0.0002	0.02
0.80	0.00	0.0000	0.00
			1.0

Upstream Mean	3σ	Mean+3 σ	Mean-3 σ
25.9	1.37	27.3	24.5

Upstream Margin (dB) Mean	Mean-3 σ	Mean+3 σ
4.0	2.6	0.2

UPSTREAM LOSS - 1310nm

Unit Loss	Total Loss	σ^2	3σ
3.70	3.70	0.0121	0.33
5.10	0.00	0.0000	0.40
7.25	0.00	0.0000	0.45
10.38	0.00	0.0000	0.63
14.10	0.00	0.0000	0.90
17.00	17.00	0.1736	1.25
0.42	2.51	0.0043	0.08
0.40	0.40	0.0044	0.20
0.25	0.75	0.0133	0.20
0.05	0.20	0.0002	0.02
0.80	0.00	0.0000	0.00
			1.0

Upstream Mean	3σ	Mean+3 σ	Mean-3 σ
25.9	1.37	27.3	24.5

Upstream Margin (dB) Mean	Mean-3 σ	Mean+3 σ
4.0	2.6	0.2



VPON CLASS B+ CALCULATOR

VPON Loss	Qty	U/M	Unit Loss (typ.)	Total Loss	σ^2	3σ
Splitter(1X2) - connectorized	1	ea	3.70	3.70	0.0121	0.33
Splitter(1X3) - connectorized	0	ea	5.10	0.00	0.0000	0.40
Splitter(1X4) - connectorized	0	ea	7.25	0.00	0.0000	0.45
Splitter(1X8) - connectorized	0	ea	10.38	0.00	0.0000	0.63
Splitter(1X16) -connectorized	0	ea	14.10	0.00	0.0000	0.90
Splitter(1X32) - connectorized	1	ea	17.00	17.00	0.1736	1.25
Fiber Length (mi)	6	mi	0.40	2.41	0.0043	0.08
Connectors (APC)	3	ea	0.25	0.75	0.0133	0.20
Splices	4	ea	0.05	0.20	0.0002	0.02
ONT Connector	1	ea	0.40	0.40	0.0044	0.20
OLT CWDM Combiner	No	ea	1.20	1.20	0.0000	0.00

VPON Loss in dB				
Mean	3 σ	Mean+3 σ	Mean-3 σ	
25.7	1.37	27.0	24.3	

Video Power Calculation

Select SBS Suppression Level	20 dBm Suppression
EDFA Output Power	20 dBm
EDFA Output Power Tolerance	0.5 dB
EDFA Power Prior to CWDM	19.5 dBm

Mean PON Loss 25.7 dB

Receiver Sensitivity at 48dB CNR Typical	Nominal	Min	Max
Received Power Limits [Max Mean Min]	-6.2	-7.5	-4.8 dBm

Margin at 48dB CNR typ. (dB)	
Margin to Overdrive	Margin to Underdrive
6.8	-2.5



GPON Characteristics

Laser Characteristics

pOLTMAX	5 dBm	Maximum OLT laser output power (Set by 1.2 GPON Max)
pOLTMIN	1.5 dBm	Minimum OLT laser output power (Set by BPON Min Out)
pONTMAX	5 dBm	Maximum ONT laser output power (FSAN 984.2)
pONTMIN	0.5 dBm	Minimum ONT laser output power (FSAN 984.2)

Fiber Characteristics

MAX LENGTH	20.0 km	Maximum Length
AGPONMAX	28.0 dB	Maximum allowed PON loss
AGPONMIN	13.0 dB	Minimum allowed PON loss

ONT Sensitivity

SONT	-27.0 dBm	ONT Sensitivity (7XX ONT)
SOLT	-28.0 dBm	OLT Sensitivity (Set by 1.2 GPON)

OLT Dynamic Range

MaxDynamic	15.0 dB	High/Low Ratio
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Fiber Characteristics

Attenuation1310	0.40 dB/km	Fiber Attenuation at 1310 nm
Attenuation1490	0.26 dB/km	Fiber Attenuation at 1490 nm
Attenuation1550	0.25 dB/km	Fiber Attenuation at 1550 nm
KmPerMi	1.6 km/mi	Distance conversion factor

VPON Characteristics

SVMING	-5.0 dBm	Min sensitivity level with guaranteed 48 dB CNR
SVMAXG	2.0 dBm	Max sensitivity level with guaranteed -53 dB CTB/CSO
Video Dynamic Range	7.0 dB	Max video dynamic range
PEDFALong	20.0 dBm	Minimum EDFA output power (Long Range)
PEDFANom	17.0 dBm	Minimum EDFA output power (Nominal Range)
SEDFA	0.5 dB	EDFA Output Variation
AVPONMAX	25.0 dB	Maximum VPON loss
AVPONMIN	15.0 dB	Minimum VPON loss
ILCWDMnom1310	0.8 dB	CWDM Insertion Loss nominal @ 1310nm

FP590 GPON Calculator
OSI Confidential and Proprietary

ILCWDMsig1310	0.0 dB	CWDM Insertion Loss sigma @1310nm
ILCWDMnom1550	1.2 dB	CWDM Insertion Loss nominal @ 1550 nm
ILCWDMsig1550	0.0 dB	CWDM Insertion Loss sigma @ 1550 nm

Calix Network Configuration & Quotation

Quote Status: ReadyToOrder
Customer Name: XCHANGE TELECOM
Author/User Name: Steven Abraham
Quote Name: 35524 Brooklyn GPON 12-11-09 v2
Contact Name: N/A

Quote Reference Number:	35524
Date Created:	12/11/09 11:39 AM
Date Modified:	12/11/09 3:51 PM
Quote Expiration:	1/11/10 3:51 PM
Offline Quote ID:	N/A

Network Diagram

